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06MAT31

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Obtain Fourier series for the function f(x) given by

$$f(x) = \begin{cases} 1+\frac{2x}{\pi}, & -\pi \le x \le 0 \\ 1-\frac{2x}{\pi}, & 0 \le x \le \pi \end{cases}$$

and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots\ldots$ **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$. **(07 Marks)**

c. Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. **(06 Marks)**

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

2 a. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \le 0 \\ 0, & |x| > \pi \end{cases}$.

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3}.\cos\left(\frac{x}{2}\right)dx$ **(07 Marks)**

b. Find the Fourier cosine transform of e^{-x^2} **(07 Marks)**

c. Find the Fourier sine transform of $e^{-|x|}$. Hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx = \frac{\pi}{2}.e^{-m}$, $m > 0$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary functions f and g from the relation $z = y^2 + 2f\left(\frac{1}{x}+\log y\right)$ **(07 Marks)**

b. Solve $\frac{\partial^3 t}{\partial x^2 \partial y}+18xy^2+\sin(2x-y)=0$ **(07 Marks)**

c. Solve $(mz-ny)\frac{\partial z}{\partial x}+(nx-lz)\frac{\partial z}{\partial y}=(ly-mx)$ **(06 Marks)**

4 a. Derive one dimensional heat equation by taking u(x, t) as the temperature, x is the distance and t is the time. (Write the figure also.) **(07 Marks)**

b. Obtain the D'Almbert's solution of the wave equation $u_{tt} = C^2 u_{xx}$, subject to the condition $u(x, o) = f(x)$ and $\frac{\partial u}{\partial t}(x,o) = o$. **(07 Marks)**

c. Obtain the various solutions of the Laplace's equation $u_{xx} + u_{yy} = 0$, by the method of separation of variables. **(06 Marks)**

PART – B

5 a. Complete the real root of the equation $x\log_{10}x - 1.2 = 0$ by Regula-Falsi method, correct to four decimal places. **(07 Marks)**

b. Solve the system of equations using Gauss-Jordan method:

$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$

(07 Marks)

c. Using the power method, find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ **(06 Marks)**

6 a. The area of a circle (A) corresponding to diameter (D) is given below: **(07 Marks)**

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105 using an appropriate interpolation formula.

b. Use Newton's divided difference formula to find f(9), given the data, **(07 Marks)**

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

c. Evaluate $\int_4^{5.2} \log_e x \, dx$ using Weddle's rule, taking 7 ordinates. **(06 Marks)**

7 a. Derive Euler's equation in the form

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

(07 Marks)

b. Find the curves on which the functional $\int_0^1 [(y')^2 + 12xy]dx$, with $y(0) = 0$ and $y(1) = 1$ can be extremised. **(07 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1+(y')^2]}\, dx$ **(06 Marks)**

8 a. Find the Z-transforms of the following :

i) $\cosh n\theta$ ii) $(n+1)^2$ **(07 Marks)**

b. Find the inverse z-transform of $\frac{z}{(z-1)(z-2)}$. **(07 Marks)**

c. Find the response of the system $y_{n+2} - 5y_{n+1} + 6y_n = u$, with $y_0 = 0$, $y_1 = 1$ and $u_n = 1$ for $n = 0, 1, 2, 3, \ldots\ldots\ldots\ldots$ by z-transform method. **(06 Marks)**

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06ME32A

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Materials Science and Metallurgy

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part..*

PART-A

1 a. Sketch any three types of Bravais lattices. **(06 Marks)**

b. Determine the relationship between atomic radius and lattice parameters in cubic systems [simple cubic, BCC and FCC]. **(06 Marks)**

c. Illustrate the steady-state diffusion. **(08 Marks)**

2 a. From the tensile stress-strain behaviour for the brass specimen shown in Fig. Q2(a), determine the following :

i) The modulus of elasticity

ii) The yield strength at a strain offset of 0.002.

iii) The maximum load that can be sustained by a cylindrical specimen having an original diameter of 12.7 mm.

iv) The change in length of specimen originally 250 mm long which is subjected to a tensile stress of 350 MPa. **(12 Marks)**

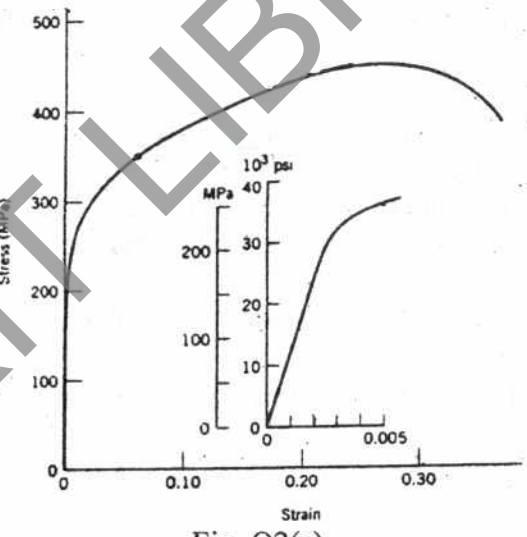

Fig. Q2(a)

b. When a 3000 kg load is applied to a 10 mm diameter ball in a Brinell test of a steel, an indentation of 3.1 mm is produced. Estimate the tensile strength of the steel. **(04 Marks)**

c. A piece of copper originally 300 mm long is pulled in tension with a stress of 270 MPa. If the deformation is entirely elastic, what will be the resultant elongation? ($E = 100 \times 10^3$ MPa) **(04 Marks)**

3 a. Illustrate the stages in the cup and cone facture **(08 Marks)**

b. What is fatigue? Draw the SN curves for i) a material that displays a fatigue limit ii) a material that does not display a fatigue limit. **(08 Marks)**

c. Explain how fatigue life can be enhanced. **(04 Marks)**

4 a. Explain unlimited suitability and limited solubility with examples **(08 Marks)**

b. A cooling curve is shown in Fig. Q4(b). Determine the following :

i) The pouring temperature
ii) The solidification temperature
iii) The superheat
iv) The cooling rate, just before solidification beings
v) The total solidification time
vi) The local solidification time.

(06 Marks)

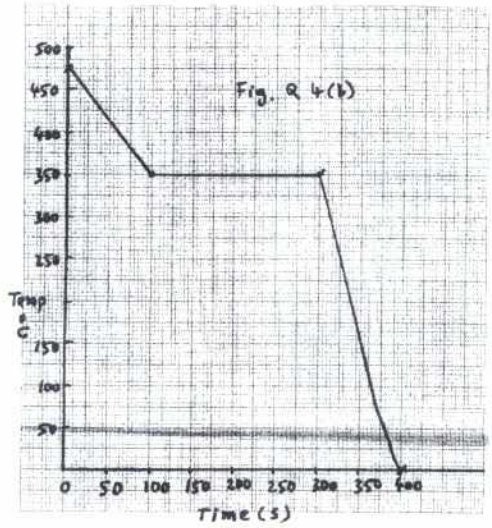

Fig. Q4(b)

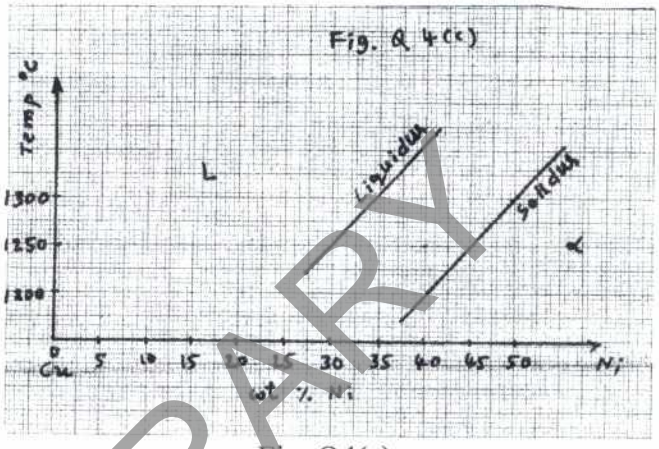

Fig. Q4(c)

c. Calculate the amounts of α and L at 1250°C and 1175°C in the Cu-40% Ni alloy shown in Fig. Q4(c). **(06 Marks)**

PART-B

5 a. Write the three invariant reactions in the Fe-Fe_3C phase diagram. **(06 Marks)**

b. What is a plain carbon steel? Discuss the transformation of eutectoid steel (0.8% C) with slow cooling. **(08 Marks)**

c. Illustrate the effects alloying elements on the eutectoid temperature of steels. **(06 Marks)**

6 a. Illustrate the variation in the microstructure of eutectoid plain-carbon steel by continuously cooling at different rates. **(12 Marks)**

b. Schematically illustrate the customary quenching and tempering process for a plan-carbon steel. **(08 Marks)**

7 a. Discuss AISI-SAE designation of steels, with examples. **(05 Marks)**

b. Show schematically, the microstructures of the following cast irons : gray iron, white iron, malleable iron, ductile iron and compacted graphite iron. **(15 Marks)**

8 a. What is corrosion? Discuss grain-grain boundary galvanic cells. **(08 Marks)**

b. Explain 'Two metal corrosion'. **(06 Marks)**

c. Explain how underground pipelines are protected using a magnesium anode. **(06 Marks)**

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06ME33

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Basic Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. Use of Thermodynamics Charts and Tables is permitted.

PART – A

1 a. Distinguish between:
i) Microscopic and macroscopic approaches of thermodynamics
ii) Intensive and extensive properties. **(06 Marks)**

b. Explain mechanical, chemical and thermal equilibrium. **(06 Marks)**

c. State zeroth law of thermodynamics. The emf, in millivolts in a thermocouple with the test junction at $t^{\circ}C$ on gas thermometer scale and reference junction at ice point is given by $e = 0.0367t + 1.33 \times 10^{-4}t^2$. The millivolt meter is calibrated at ice point and steam points. What will this thermometer read in a place where the gas thermometer reads $50^{\circ}C$? **(08 Marks)**

2 a. Define thermodynamic work and heat. **(04 Marks)**

b. Derive an expression for displacement work for polytropic process. **(06 Marks)**

c. A cylinder contains one kg of fluid at an initial pressure of 20 bar. The fluid is allowed to expand reversibly behind a piston according to law $PV^2 = C$ untill the volume is doubled. The fluid is then cooled reversibly at constant pressure untill the piston regains its original position, heat is then supplied reversibly with the piston firmly locked in this position untill the pressure rises to the original value of 20 bar. Calculate the net work done by the fluid for an initial volume of $0.05m^3$. **(10 Marks)**

3 a. State : i) I law of thermodynamics as applied to a closed system
ii) Two-property rule. **(04Marks)**

b. A fluid system undergoes a non-flow frictionless process following the pressure – volume relation as $P = \frac{5}{V} + 1.5$, where P is in bar and V is in m^3. During the process volume changes from $0.15m^3$ to $0.05m^3$ and the system rejects 45 kJ of heat. Determine: i) Change in internal energy ; ii) Change in enthalpy. **(08 Marks)**

c. A fluid flows steadily through a rotary device. For a kg of fluid, the heat transfer out of the device is 25 kJ. The fluid properties at the entry are 5 bar, 50 m/s and 0.78 m^3/kg. The corresponding properties at the exit are 1 bar, 100 m/s and $0.97m^3/kg$. The inlet is 5m above the exit and the internal energy at the entry is greater than that of exit by 119 kJ. Find the out put work. **(08 Marks)**

4 a. Represent schematically heat engine, heat pump, and refrigerator. Give their performance. **(06 Marks)**

b. Prove that Kelvin Planck and Claussius statements of second law of thermodynamic are equivalent. **(07 Marks)**

c. A heat engine is used to drive a heat pump. The heat transfers from the heat engine and the heat pump are used to heat the water circulating through a radiator of a building. If the COP of the heat pump is 4 and the efficiency of the heat engine is 0.3, how much heat is transferred to the radiator water for every kJ heat transferred to the heat engine? **(07 Marks)**

PART – B

5 a. State and prove "Clausius inequality". **(06 Marks)**

b. Define entropy and prove that it is a property of the system. **(06 Marks)**

c. Obtain an expression for entropy change of a closed system when it undergoes a polytropic process. **(08 Marks)**

6 a. Define :

i) Available energy

ii) Availability

iii) Effectiveness. **(06 Marks)**

b. Obtain an equation for maximum work available in a non – flow system. **(06 Marks)**

c. A system at 500 K receives 7200 kJ/min from a source at 1000 K. The temperature of atmosphere is 300 K. Assuming that the temperatures of system and source remain constant during heat transfer, find out

i) The entropy produced during heat transfer.

ii) The decrease in available energy after heat transfer. **(08 Marks)**

7 a. Write a neat P – T diagram for a pure substance and define : i) Tripple point ; ii) Critical point. **(06 Marks)**

b. Define :

i) Sensible heat of water

ii) Latent heat and

iii) Dryness fraction. **(06 Marks)**

c. The following data were obtained in a test on a combined separating and throttling calorimeter.

Pressure of steam sample = 15 bar

Pressure of steam at exit = 1 bar

Temperature of steam at exit = 150°C

Discharge from separating calorimeter = 0.5 kg/min

Discharge from throttling calorimeter = 10 kg/min. Determine the dryness fraction of the sample of steam. **(08 Marks)**

8 a. Write a short note on Vander Wall's equation. **(05 Marks)**

b. Explain reduced properties and compressibility chart. **(05 Marks)**

c. A vessel of capacity $3m^3$ contains 1 kg mole of N_2 At 90°C

i) Calculate pressure and specific volume of gas

ii) If the ratio of specific heats are 1.4, obtain cp and cv

iii) Subsequently, the gas cools to the atmospheric temperature of 20°C; evaluate the final pressure of gas.

iv) Evaluate the increase in specific internal energy, the increase in specific enthalpy, increase in specific entropy and heat transfer. **(10 Marks)**

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06ME34

Third Semester B.E. Degree Examination, Dec.09-Jan.10
Mechanics of Materials

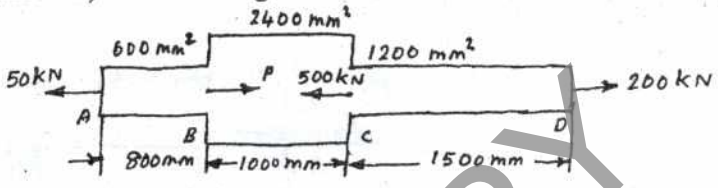
Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each Part.***

PART - A

1 a. Define i) stress ii) principle of super position. **(04 Marks)**

b. A member ABCD is subjected to point loads as shown in fig.Q1(b), calculate i) Force P necessary for equilibrium ii) Total elongation of the bar. Take E = 210 GN/m^2.



(06 Marks)

Fig.Q1(b)

c. Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 500mm apart. Diameters and lengths of each rod are 20mm and 4m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5kN, such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take $E_s = 2 \times 10^5$ N/mm^2 and $E_c = 1 \times 10^5$ N/mm^2. **(10 Marks)**

2 a. Define Bulk modulus. Derive an expression for Young's modulus in terms of bulk modulus and Poisson's ratio. **(08 Marks)**

b. i) Define Thermal stress. **(02 Marks)**

ii) Calculate the values of the stress and strain in portion AC and CB of the steel bar shown in Fig Q2b (ii). A close fit exists at both the rigid supports at room temperature and the temperature is raised by 75^{0}C. Take E = 200GPa and $\alpha = 12 \times 10^{-6}$ per ^{0}C for steel. Area of cross – sections of AC is 400 mm^2 and of BC is 800 mm^2. **(10 Marks)**

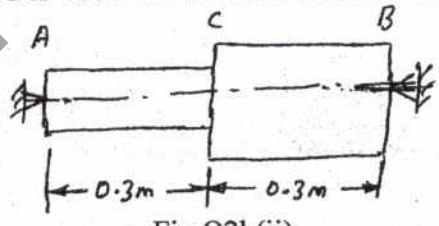
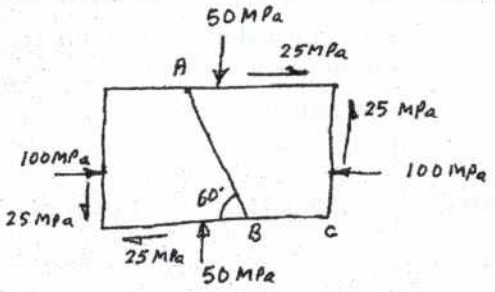


Fig.Q2b(ii)

3 a. Define i) principal stress ii) principal strain. **(04 Marks)**

b. A machine component is subjected to the stresses as shown in Fig. Q3(b). Find the normal and shearing stresses on the section AB inclined at an angle of 60^0 with x – x axis. Also find the resultant stress on the section. Verify the above results by drawing Mohr's circle.



(16 Marks)

Fig.Q3(b)

4 a. Derive an expression for circumferential stress and longitudinal stress for a thin shell subjected to an internal pressure. **(06 Marks)**

b. Derive an expression for the radial pressure and hoop stress for a thick spherical shell. **(06 Marks)**

c. A thick spherical shell of 200mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2. If the permissible tensile stress in the shell material is $8N/mm^2$, find the thickness of the shell. **(08 Marks)**

PART - B

5 Draw the bending moment and shear force diagrams for the beam loaded as shown in fig. Q5. **(20 Marks)**

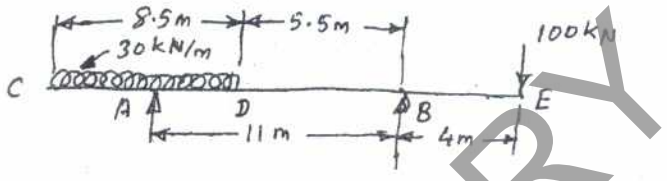


Fig.Q5

6 a. Prove the relations $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. A T – shaped cross – section of a beam in fig.Q6(b) is subjected to a vertical shear force of 100kN. Calculate the shear stress at the neural axis and at the junction of the web and the flange. M.I. about the horizontal neutral axis is 0.0001134 m^4. **(10 Marks)**

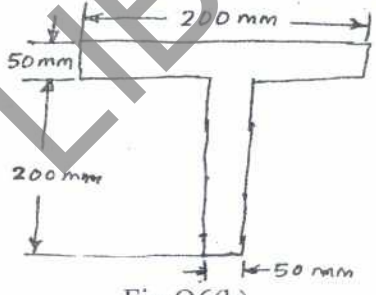


Fig.Q6(b)

7 A beam of length 6m is simply supported at its ends and carries two point loads of 40kN at a distance of 1m and 3m respectively from the left support. By using Macaulay's method, determine : a) deflection under each load b) maximum deflection c) the point at which maximum deflection occurs. Given $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6 mm^4$. **(20 Marks)**

8 a. Two shafts of the same material and of same lengths are subjected to the same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts. **(10 Marks)**

b. A 1.5m long column has a circular cross section of 50mm diameter. One of the ends of the column is fixed in direction and position and other end is free. Take factor of safety as 3, calculate the safe load using :

i) Rankine's formula, take yield stress = $560N/mm^2$ and $a = \frac{1}{1600}$ for pinned ends.

ii) Euler's formula, Young's modulus for C.I. = 1.2×10^5 N/mm^2. **(10 Marks)**

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06ME35

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Manufacturing Process – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What do you understand by the term 'manufacturing'? Discuss the factors to be considered in the selection of a process for production. **(05 Marks)**

b. Define the casting process. Discuss the advantages and disadvantages of the casting process. **(05 Marks)**

c. List the different allowances given on a pattern. Sketch and explain the loose piece pattern. **(05 Marks)**

d. Write a note on binders and additives, used in moulding. **(05 Marks)**

2 a. What are the desirable properties of a moulding sand? **(05 Marks)**

b. What is meant by a core? Sketch and explain a balanced core. **(05 Marks)**

c. Draw a neat sketch of a gating system showing all the elements. **(05 Marks)**

d. Explain with a sketch, the working of jolt type moulding machine. **(05 Marks)**

3 a. With neat sketches, briefly explain the different steps involved in shell moulding process and mention its advantages. **(10 Marks)**

b. With a neat sketch, explain continuous casting process and mention its advantages. **(10 Marks)**

4 a. Explain the construction and working principle of a Cupola furnace, with a sketch. **(12 Marks)**

b. Explain with a sketch, working of a direct arc electric furnace. **(08 Marks)**

PART – B

5 a. Define welding process. What are the advantages of welding over other manufacturing processes? List the industrial applications of welding. **(08 Marks)**

b. Explain the following welding processes with necessary sketches and their field of applications. i) Tungsten inert gas welding (TIG) ii) Atomic hydrogen welding (AHW). **(12 Marks)**

6 a. With neat sketches, explain:
i) Seam welding ii) Projection welding **(12 Marks)**

b. With a sketch, explain the electron beam welding. Mention its applications. **(08 Marks)**

7 a. Discuss the need for the following, in welding:
i) Flux ii) Filler material iii) Electrodes. **(06 Marks)**

b. Explain the different welding defects, their causes and remedies. **(10 Marks)**

c. Write a note on residual stresses, in welding. **(04 Marks)**

8 a. Explain soldering and brazing, with examples. Mention their advantages and disadvantages. **(08 Marks)**

b. Explain the following, with neat sketches:
i) X-ray radiography
ii) Optical holography. **(12 Marks)**

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06ME36A/06ME46A

Third Semester B.E. Degree Examination, Dec.08/Jan.09
(ME/IP/AU/IM/MA/AE/MI)
COMPUTER AIDED MACHINE DRAWING

Time: 3 hrs. **Max. Marks: 100**

Note: 1. Answer any **ONE** question from each of the parts **A, B** and **C**.
2. Use **FIRST ANGLE** projections only.
3. Missing data if any may suitably be assumed.
4. All the calculations should be on answer sheet supplied.
5. All the dimensions are in mm.
6. Drawing instruments may or may not be used for sketching
7. **Part C Assembled View should be in 3D and other 2 views in 2D.**

PART – A

1. A hexagonal pyramid sides of base 30mm and altitude 70mm is rests with its with its base on the HP and with a side of base parallel to the VP. It is cut by a cutting plane inclined at 35^0 to the HP and perpendicular to the VP and is bisecting the axis. Draw the front view, the sectional view looking from the top and true shape of section. **(20 marks)**

2. Draw two views of hexagonal headed bolt with nut for a 30mm diameter bolt. Take length of bolt equal to 125mm. **(20 marks)**

PART – B

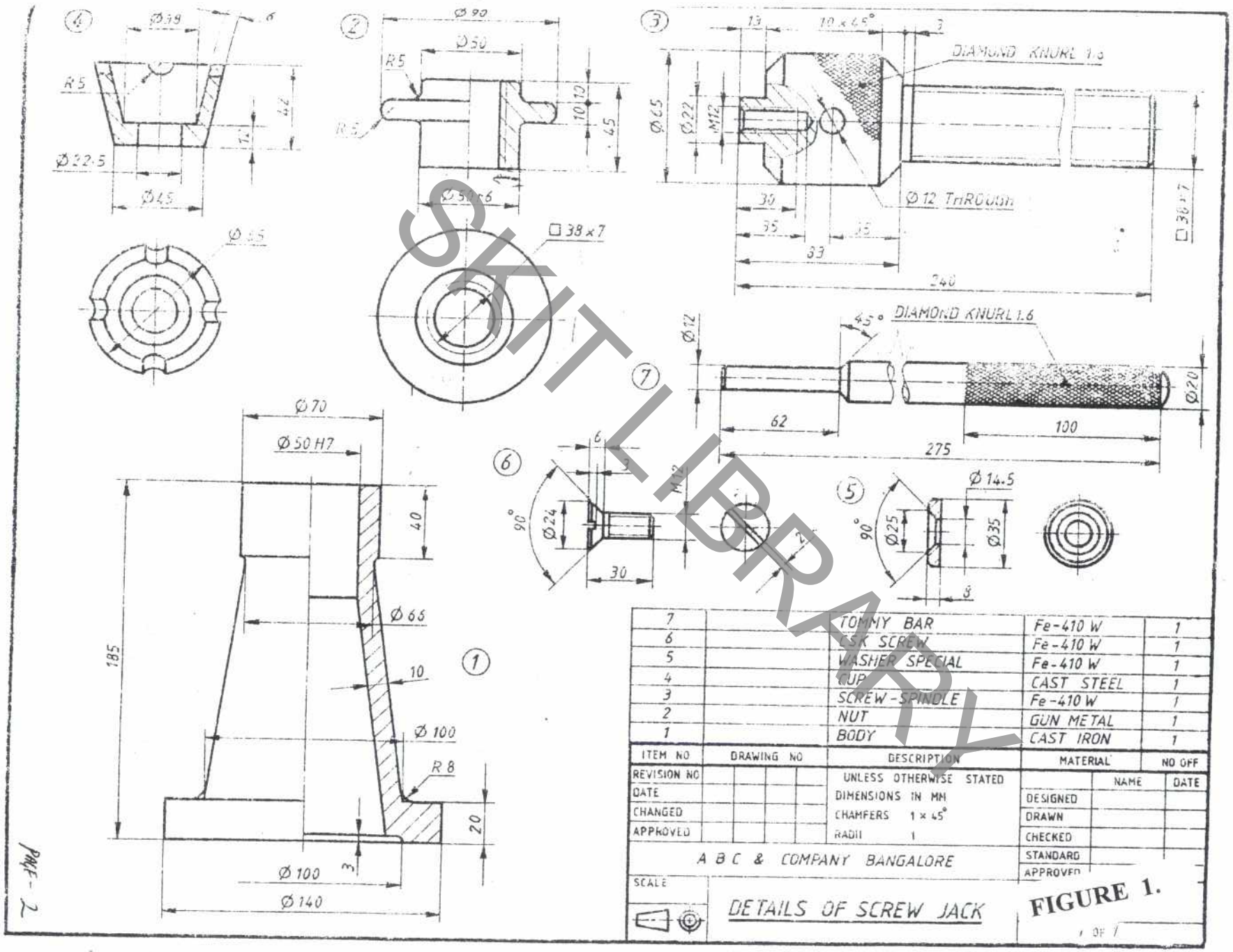
3. Draw the top view and sectional front view of single riveted butt joint with double cover plates. The thickness of plate is 14mm. Show at least three rivets. Indicate all the dimensions. Use snap head rivets and show all calculation on the answer sheet. **(20 marks)**

4. Draw bushed-pin type of flexible coupling to connect two shafts of 20mm diameter for the following views:
   (a) Front view with top half in section.
   (b) Side view from pin-head end. **(20 marks)**

PART – C

5. Figure 1. shows the details of Screw Jack. Assemble the parts and draw the following views: (i) Front View showing right half in section and (ii) Top View **(60 marks)**

6. Figure 2. shows the details of a Tool Head of a Shaper. Assemble the parts and draw
   (i) Sectional Front View.
   (ii) Top View. **(60 marks)**



ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF
7		TOMMY BAR	Fe-410 W	1
6		CSK SCREW	Fe-410 W	1
5		WASHER SPECIAL	Fe-410 W	1
4		CUP	CAST STEEL	1
3		SCREW-SPINDLE	Fe-410 W	1
2		NUT	GUN METAL	1
1		BODY	CAST IRON	1

REVISION NO					
DATE					
CHANGED					
APPROVED					

UNLESS OTHERWISE STATED
DIMENSIONS IN MM
CHAMFERS 1 x 45°
RADII 1

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
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A B C & COMPANY BANGALORE

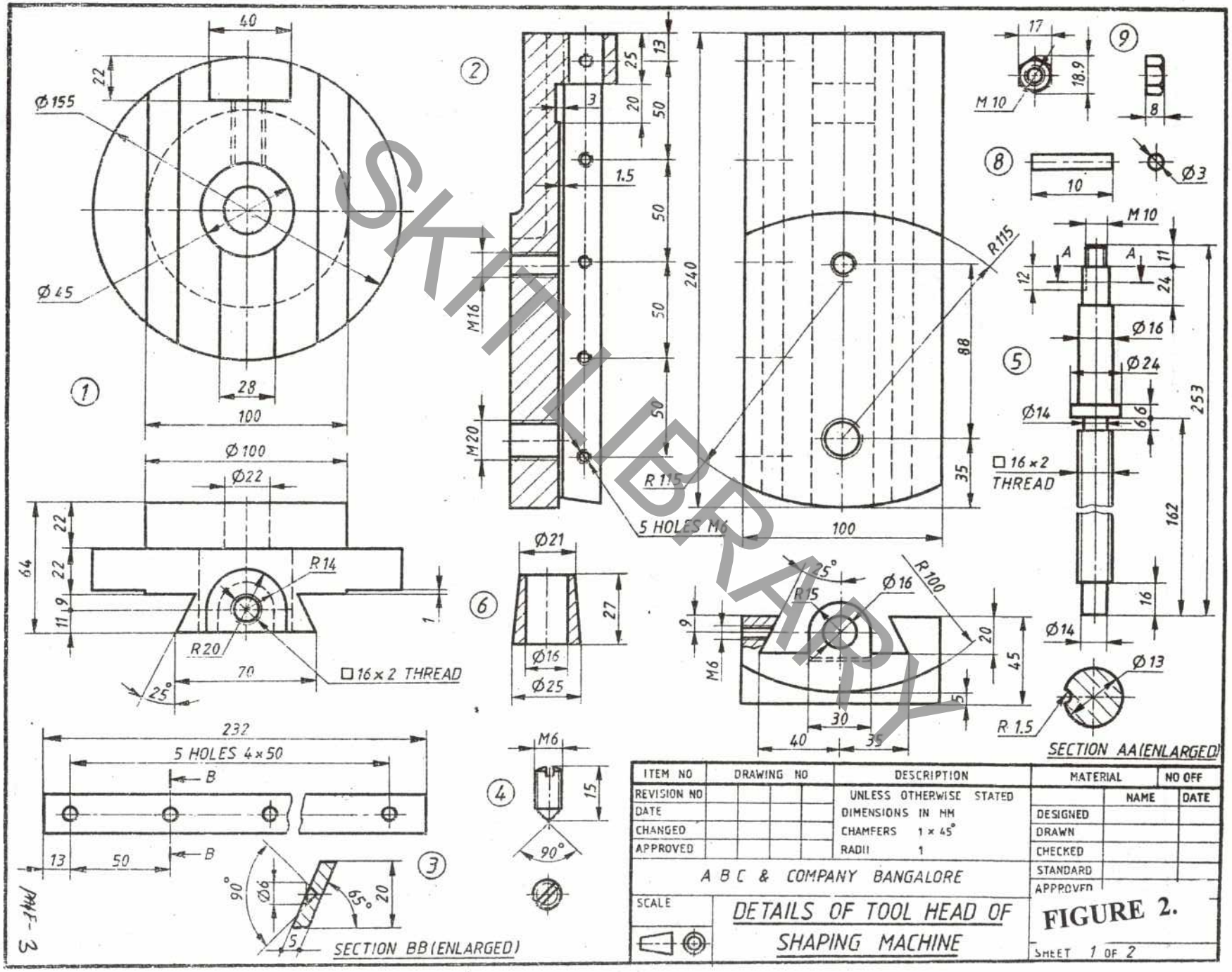
SCALE

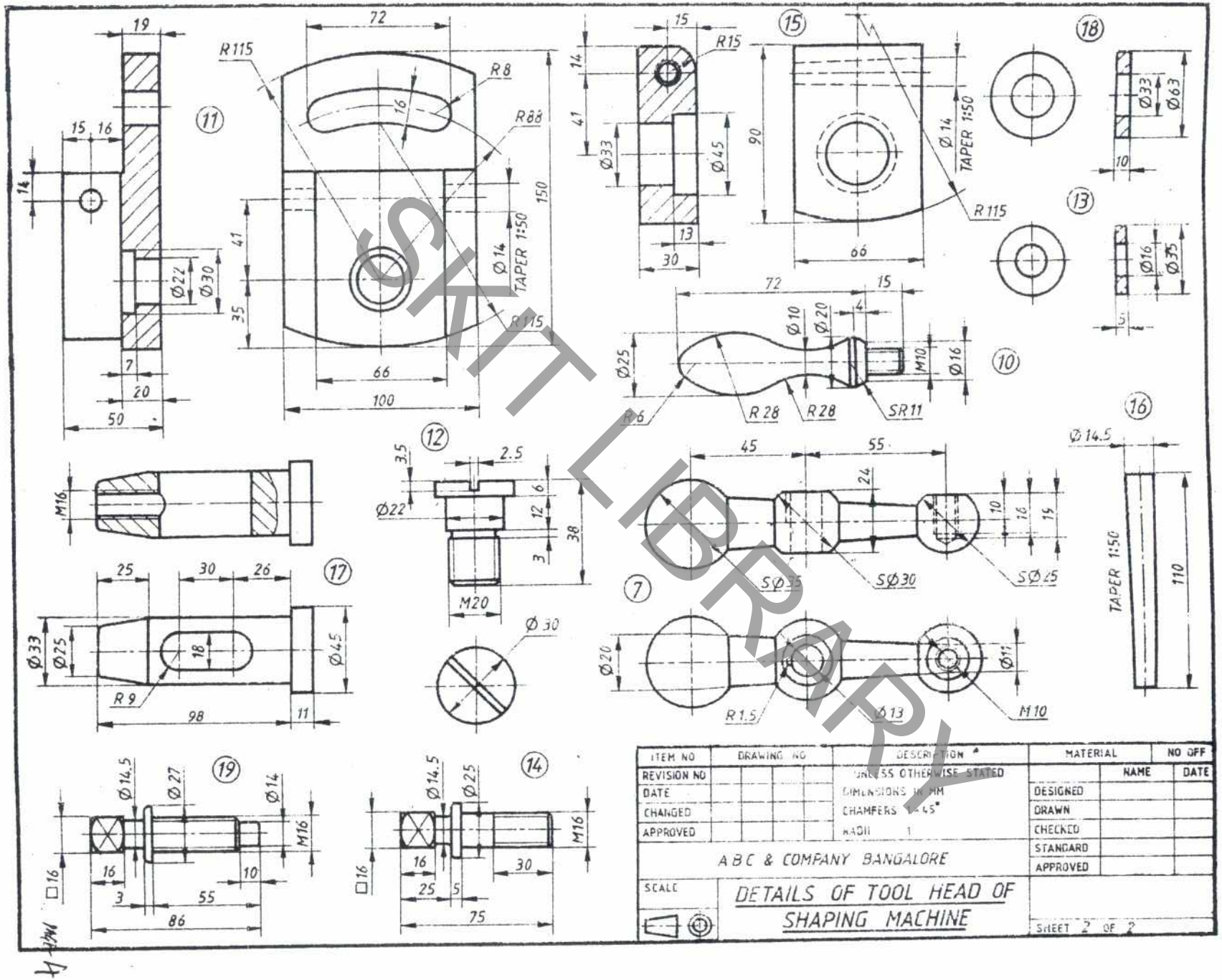
DETAILS OF SCREW JACK

FIGURE 1.

1 OF 1

PMF-7





III ME

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MATDIP301

Third Semester BE Degree Examination, Dec.09-Jan.10
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Find the modulus and amplitude of $\frac{4+2i}{2-3i}$. **(06 Marks)**

b. Express the complex number $2 + 3i + \frac{1}{1-i}$ in the form of a + ib. **(07 Marks)**

c. Express the complex number $\sqrt{3} + i$ in the polar form. **(07 Marks)**

2 a. Find the n^{th} derivative of $e^{-x} \sin^2 x$. **(06 Marks)**

b. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)} + e^{2x}$. **(07 Marks)**

c. If $y = \sin^{-1} x$ then prove that $(1 + x^2) y_{n+2} - (2n + 1) x y_{n+1} - n^2 y_n = 0$. **(07 Marks)**

3 a. Using Maclaurin's series expand tanx upto the term containing x^3. **(06 Marks)**

b. Find the angle between the radius vector and tangent to the curve $r = \sin\theta + \cos\theta$. **(07 Marks)**

c. With usual notations prove that

i) $P = r\sin\phi$

ii) $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$. **(07 Marks)**

4 a. If $u = f(r, s, t)$ where $r = \frac{x}{y}$, $s = \frac{y}{z}$, $t = \frac{z}{x}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$. **(06 Marks)**

b. If $u = f(x + ay) + g(x - ay)$ then show that $\frac{\partial^2 u}{\partial y^2} = a^2 \frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

c. If $u = x^2 - 2y$, $v = x + y + z$, $w = x - 2y + 3z$ then find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. **(07 Marks)**

5 a. Obtain the reduction formula for $\int \cos^n x dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate $\int_0^1 x^6 \sqrt{1 - x^2}\, dx$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)\, dy dx$.. **(07 Marks)**

6 a. Evaluate $\int_0^1\int_0^2\int_1^2 x^2yz \; dzdydx$. **(06 Marks)**

b. Prove that $\sqrt{\frac{1}{2}} = \sqrt{\pi}$. **(07 Marks)**

c. Show that $\int_0^{\pi/2} \sqrt{\text{Sin}\theta} \; d\theta \; x \int_0^{\pi/2} \frac{d\theta}{\sqrt{\text{Sin}\theta}} = \pi$. **(07 Marks)**

7 a. Solve $(e^y + 1)\,\text{Cos}x dx + e^y \,\text{Sin}x \, dy = 0$. **(06 Marks)**

b. Solve $ydx - xdy = \sqrt{x^2 + y^2}\, dx$. **(07 Marks)**

c. Solve $x\frac{dy}{dx} + y = x^3y^6$. **(07 Marks)**

8 a. Solve $4\frac{d^3y}{dx^3} + 4\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 3x = \text{Sin}t + e^{-t}$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$. **(07 Marks)**

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